

## 49. Notes on East African Insects collected 1915-1922.

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It was my intention on returning to England after my first term in East Africa (1915-1919) to publish such field-notes as were of general interest as each order of insects was worked out, over twenty thousand insects having been collected.

The difficulty of getting these determinations performed has, however, prevented the carrying out of my original plan, and as these notes are accumulating, I have made sundry extracts from my journal in the hope that entomologists may find amongst these casual jottings something of interest.

The present miscellany is divided into two parts, (A) being a list of Hymenoptera and their Dipterous mimics taken at Kilosa, and (B) more general observations on Hymenoptera, Coleoptera, Lepidoptera, and Orthoptera. Next year, when more of the material will have been identified, it may be possible to publish a second instalment covering the same and other orders.

Localities may be grouped as follows:—

## 1. KENYA COLONY (late British East Africa).

Frere Town, on mainland opposite Mombasa Island.  
Mbunyi, north of Taveta and west of Kilimanjaro.  
Nairobi, 327 miles west of Mombasa.  
Ngoug, some six miles from Nairobi.

## 2. TANGANYIKA TERRITORY (late German East Africa).

Dutumi, in Morogoro District.  
Handeni, in Pangani District.  
Izikisia, 40 km. N.E. of Tabora in Tabora District.  
Kahe, in Moshi District.  
Kilosa, 80 km. W. of Morogoro in Morogoro District.  
Longido West, *i. e.* west District of Mt. Longido, Arusha.  
Myombo, 75 km. W. of Morogoro in Morogoro District.  
Mkomasi, 30 km. N.W. of Lushoto in Usambara District.  
Morogoro, on Central Railway, 2100 km. west of Dar es Salaam.  
Moshi, on Tanga Railway in Moshi District.  
Ngari Mtoni, six miles west of Arusha, Arusha District.  
Ngeri-nger River, south of Ngeri-nger Station, Cent. Rly.  
Singida, 120 km. north of Kilamatinde in Dodoma District.  
Tambali, in Tabora District.

## 3. PORTUGUESE EAST AFRICA.

Lumbo is the railhead on mainland 3 miles from Mozambique.

My thanks are due to Professor Poulton for getting most of the identifications made (the work has been particularly difficult owing to rough handling of a store-box in the post, resulting in many of the specimens being badly damaged and in some cases detached from their labels), for proof-reading and his many kindnesses and ready help; to W. C. Crawley, The Rev. F. D. Morice, Dr. J. Waterston (Hymenoptera); Major E. E. Austen, D.S.O., E. Brunetti, F. W. Edwards (Diptera); G. J. Arrow, K. G. Blair (Coleoptera); B. Uvarov (Orthoptera); Dr. F. A. Dixey, Prof. E. B. Poulton, W. H. T. Tams (Lepidoptera); A. S. Hirst (Arachnida), for making the determinations; and to my chief, Mr. C. F. M. Swynnerton, for the interest he has always shown in entomological pursuits, particularly those connected with mimicry and warning coloration.

The material referred to in the following pages is preserved in the Hope Department of the Oxford University Museum, where it may be studied by any naturalist.

## A. HYMENOPTERA AND THEIR DIPTEROUS MIMICS.

With one exception all the models and mimics mentioned below were taken within an area of 300 square yards on the Otto Plantation, Kilosa, Tanganyika Territory, and with six exceptions (mimics 4, 6, 8, 11, 38, & 40) all were taken on the mosquito gauze protecting the verandahs of one or other of two houses not more than two hundred yards apart and in the same clearing. This rather adds to the interest of the specimens, and it will be understood that unless otherwise stated all the specimens were taken on this gauze.

The actual specimens referred to in the notes were received for every number except, perhaps, No. 34, which is a little uncertain.

1. *XYLOCOPA INCONSTANS* Sm., ♀. 31.iii.21. Only a single example of this Carpenter-bee taken, a very perfect model to (4). The timber of both these houses is infested with the borings of (2) and (3), which I consider form an association in the matter of markings or colour from which (4) is likely to benefit.

2. *XYLOCOPA CAFFRA* L., ♀. 13.iv.22. Very common.

3. *XYLOCOPA NIGRITA* F., ♀. 24.iv.22. Very common.

4. *HYPERECHIA BIFASCIATA* Grünb., ♀ (Laphrinæ: Asilidæ). 13.iv.22. This Dipterous mimic was taken at 8 a.m. resting in bright sunshine on the verandah-rail just four feet below the nesting-holes of *X. nigrata* F. When approached it flew with a faint buzz to the rain-gutter on the roof and right alongside the nesting-holes: netted.

5. *PSAMMOCHARES* sp., probably *VENANS* Kohl (Pompilidæ: Fossoria). 6.vi.21. Very common, as also several similarly-coloured but larger species, which can be seen flying about the paths and open clearings on any sunshiny day.

6. *ORECTOCERA DIABOLUS* Wied. (Tachinidæ). 17. iv. 22. When walking down a steep path at 1.45 p.m., I noticed this Dipterous insect fly up suddenly—the flight was short and rapid—and, alighting again upon the path, it ran to and fro with jerky movements of the abdomen till it reached a stone, upon which it rested. The movements were almost identical with those of (5) and its allies. The fly must be very scarce here, as I have not met with it before during twelve months' residence at Kilosa.

7. *SYNAGRIS CARINATA* Sauss., var. *ALBONOTATA* Beq., ♀ (Eumenidæ: Diptoptera). 1. iv. 22. Very common, as are many other similarly-coloured wasps, blue being their common livery as yellow and black is for the vespids at home. *Rhynchium luctuosum* Gerst. is one of these; it also enters into the colour association of No. 5.

8. *BROMOPHILA CAFFRA* Macq. (Ortalidæ). 9. ii. 21. On a leaf beside the path, almost at the same spot as (6). I do not regard this fly as a direct mimic of (7), but it must derive advantage from adopting the livery of the wasps, which are so common. On 17. iii. 17 I took a number of these flies on flowers and herbage at Morogoro, and noted at the time their slowness of movement. This sluggishness was so pronounced that it was not a difficult matter to catch them by hand\*.

9. *EUMENES MAXILLOSA* de G., ♀ (Eumenidæ). 9. iv. 22.

10. *EUMENES DYSCHYROIDES* Gribodo, ♀. 29. i. 21.

11. *PHYSOCEPHALA* sp., ♀ (Conopidæ). 25. iii. 22. I think this is a perfectly wonderful mimic of (9) and (10), but the semi-transparent wings are more like those of other hornets taken here whose abdomens, however, are normal-shaped. This fly was resting on the blossom of a *Zinnia* at 5.30 p.m., and buzzed loudly when caught by the fingers; it was extremely sluggish. In my diary I have just come across the following note under date 3. v. 17, Morogoro. "Took a fly from a spider's web; it is the very image of the long-waisted wasp. I was deceived by its appearance at first, but the spider was serenely tackling it." Whether this is the same species I cannot say, as the fly was sent home for identification and cannot be traced at the moment. It is either in the Nairobi or British Museum (Nat. Hist.).

12. *PSANMOCHARES* sp. A. (Pompilidæ: Fossoria). 1. v. 22. Scarce, at least in the houses; there is a bee here very similarly coloured which I have taken several times.

\* The fly ejects yellow liquid from its mouth when handled, and was refused by Dr. G. A. K. Marshall's baboons and *Cercopithecus* (Trans. Ent. Soc. Lond. 1902, p. 531). *Bromophila caffra* is figured by Dr. Marshall on plate xxiii. fig. 27, as one of a S. Rhodesian group of insects with "black bodies, blue wings, and red or yellow heads" (figs. 20-27). See also Dr. G. D. H. Carpenter in Proc. Ent. Soc. 1918, p. c, and Trans. Ent. Soc. 1921, p. 72.

13. *NEGRITOMYIA MACULIPENNIS* Lw. (Stratiomyidæ). 2.i.22. This fly was buzzing up and down the white ceiling of a lighted room, when it was approached by an exceptionally large gecko (*Hemidactylus mabouia*), who followed its movements for some time, but hesitated to take it.

13 a. 6.iv.22. Another example with closed wings, showing its close resemblance to the model. During the five months since 2.i.22 five specimens were taken on the gauze, it being about equally common with the model in this situation. There is a bee here very similarly coloured.

14. *APIS MELLIFERA ADANSONI* Latr. 22.iii.22. This bee is a plague, existing in countless thousands in the plantation and often making its combs in the houses (see p. 1019).

15. *ERISTALODES QUINQUEMACULATUS* F., ♀ (Eristalinæ: Syrphidæ). 2.i.22. Common but not exactly plentiful; buzzes like the bee both in flight and when caught; it causes quite a pricking of the fingers with its feet when held. On 31.iii.22 I caught one of these flies and offered it to my monkey (*Cercopithecus albigrularis rufilatus*), who would have nothing to do with it though he eyed it closely. I then proffered it to a Fennec Fox (*Octocyon virgatus*), who was watching me and was within two feet of the monkey at the time. He promptly snapped it out of my fingers and crunched it up. I then released the monkey, who went off hunting grasshoppers, and was still busy feeding when I went to bring him in half-an-hour later, so it was not a question of satiety\*.

16. *MEGACHILE* sp., ? *UNGULATA* Smith, ♀ (Apidæ: Anthophila). 6.vi.21. A common wild bee. Another bee, *Nomia vulpina* Gerst., would act as a model with (16), as also with (14), and (39); and all four species form together a compound colour association into which still other bees probably enter.

17. *SIMOIDES CRASSIPES* F., ♀ (Eristalinæ). 21.iii.22. A mimic of (16).

18. *PSAMMOCHARES* sp. B. 1.iv.22. Common.

19 & 19 a. *PLAGIOSTENOPTERINA SUBMETALLICA* Lw. (Stenopterinae: Ortalidæ). 11. & 15.v.22. In houses even commoner than the alleged model; when walking slowly up the gauze with closed wings they look very waspish.

20. *ICARIA ANBIGUA* Gribodo (Vespidæ: Diploptera). 1.iv.22. This wasp builds small nests on the verandah, where the little colonies of from two to five individuals are quite a common spectacle.

21. *ODYNERUS TROPICALIS* Sauss., ♀ (Vespidæ). 1.iv.22. A closely-related species with similar habits.

\* Compare Dr. Carpenter's experiments on monkeys with *Eristalis tenax* L. (Trans. Ent. Soc. 1921, pp. 25, 31, 33, 72, 100).



22. *DACUS PECTORALIS* Walk. (Trypetidæ). 1. iv. 22. On taking this fly, I went and captured examples of the models from close by. This wonderful mimic is apparently commoner than the model, but not so in reality I believe, the explanation being that on entering the house it immediately flies to the gauze to escape, while the wasps, knowing their way about, make straight for their nests. Accompanying (22) were two other somewhat smaller but very similar species, together with the following.

22 *a*. *DACUS BREVISTYLUS* Bezzi. 21. iii. 22. A smaller species, and possibly forming a protective association with (22).

23. *CERCERIS* sp., ♀ (Sphegidæ : Fossoria). 1. v. 22. Not so common as (20) or (21). The very similar *Icaria distigma* Gerst. was also taken.

24. *DACUS* sp. nr. *LOUNSBURYI* Coq., ♀. 13. iv. 22. The only specimen taken.

25. *PANISCUS OPACULUS* Thoms., very near the British *testaceus* Holmgr. (Ophioninæ : Ichneumonidæ). 2. i. 22. A common ichneumon fly.

26. A species of *PIMPLINÆ* (Ichneumonidæ) not in Brit. Mus. 9. iv. 22. By no means abundant.

27. *PLATYURA* sp. (Mycetophilidæ). 11. v. 22. The only specimen of this Dipteron I have taken, though I have seen but not captured others.

28. A species of *MICROPEZIDÆ* (Diptera). 2. i. 22. Common.

29. *PLECTICUS ELONGATUS* F., ♀ (Stratiomyidæ). 2. i. 22. Very common. It will be observed that the model (25) and Dipterous mimics (28) and (29) were taken on the same day, and not only so but at the same time, on the same gauzed window within a radius of two feet. I have subsequently seen the model and mimic together on several occasions.

29 *a*. *STYLOGASTER* sp. (Conopidæ). 11. v. 22. Only a single specimen taken of this very ichneumon-like Dipteron.

30. *PISON* sp., probably *XANTHOPUS* Brullé (Sphegidæ : Fossoria). 15. iv. 22. Common.

31. *NOMIA* sp., probably same as unnamed species from Entebbe in Brit. Mus. (Andrenidæ : Anthophila). 27. iii. 22. Common. Another bee of the genus *Halictus* probably enters the same association.

32. *SARGUS* sp. (Stratiomyidæ) and 32 *a*. Probably *SARGUS* sp. 20. iii. 22 & 9. iv. 22. Dipterous mimics of (30) and (31); with closed wings they are very bee-like.

33 and 33 *a*. *EUMERUS* sp. (Syrphidæ). 3. i. 22 & 6. i. 22. Bee mimics. (33 *a*) has its wings set in the attitude of rest seen in life.

34. Number missing. A large example of No. 31 bears the following date, but it is rather small as a model for (35). 24. i. 22. Bee.

35. *MICRODON* sp. (Syrphidæ). 17.iv.22. A very bee-like fly when seen walking up the gauze; the illusion is accentuated by the faint buzz it gives when caught.

36. *ISCHIODON SCUTELLARE* F., ♀ = *SYRPHUS ÆGYPTIUS* Wied. (Syrphinae). 1.v.22. This hover-fly is very like its English relative in appearance, and does not resemble closely any particular wasp which I have taken locally.

37 and 37a. *RHYNCHIUM* sp., prob. *RADIALE* Sauss. (Eumenidæ: Diptoptera). 20.iii.22 & 14.i.22. A common wasp.

38. *ANCYLORRHYNCHUS* Latr. (= *XIPHOCERUS* Lw.) sp., ♀ (Dasypogoninae: Asilidæ). 31.iii.21. Rare: a pair was taken *in cop.* in the open. A very beautiful general mimic, whose capture recalled exciting moments with my first *Asilus crabroniformis* L. in Cornwall.

39. *MEGACHEILE PILICRUS* Mor., ♀ (Apidæ: Anthophila). 7.i.22. A very common form of bee; there are many species with similar markings, either with the transverse bars similarly coloured or picked out in blue or chrome.

40. *SISYRNODYTES* sp., prob. new, ♀ (Dasypogoninae). 26.viii.21. This is the only specimen of the above series not taken at Kilosa, but at Mkata River some twenty-five miles away. The model or members of the group of models are almost sure to be found at Mkata, where I did practically no collecting. This fly, so far as my memory serves, was captured because it alighted on my coat sleeve.

## B. GENERAL OBSERVATIONS ON INSECTS.

### HYMENOPTERA.

The actual specimens referred to in the following notes on Hymenoptera were only received for Nos. 41 and 49.

41. A species of *BETHYLIDÆ*, now regarded as Fossorial Hymenoptera (Proc. Ent. Soc. Lond. 1922, p. xxvi). This small Hymenopteron, so ant-like in habit and in the way it runs about, bites (or stings?) most painfully. The usual place to find them was on the back of one's neck inside the collar, where they had probably got by dropping from the thatched roof. Owing to their numbers they constituted quite a pest at Jumbe Mbulu's. (Singida, Dodoma Dist., 11. x. 21.)

42. *CHRYSIDIDÆ*. (Actual specimens not available, and it is unsafe to give names of others.) Some Chrysidids, four in number, on my window had evidently just emerged from their host cell, for one of their number still had the paper cap of its cell adhering to its feet. (Morogoro, 29. ii. 17.)

43. *XYLOCOPA CAFFRA* L. My native collector having left one of these bees in my butterfly net I received a sting. The pain was very sharp but soon subsided, and no swelling resulted. (Morogoro, 10. i. 17.)

44. *XYLOCOPA TORRIDA* Westw., ♀. When resting in their holes these bees effectually close the opening of the hole with the dorsal surface of their abdomen pressed closely against it, yet the tip also so placed as to leave the sting operative. As a result I have twice been stung—the first time when leaning against a pole in a hut, and to-day when removing a rubber-tree pole which was infested with these carpenter-bees. I inadvertently placed my hand over one of the entrances, and was promptly stung on the tip of the second finger of the left hand. The pain was intense for a quarter of an hour—fully as bad as that of a scorpion sting. Blue was applied for ten minutes and the pain passed off. By 4 p.m. there was only a stiffness and soreness. The following morning the top section of the finger was much swollen, hard and very tender, and so remained for three days. (Kilosa, 17–20. i. 22.)

45. *MELIPONA BRAUNSI* Kohl (Apidæ: Anthophila). This bee, which for my own convenience I have christened "the thirsty bee," was very much in evidence at Lembeni and Dutumi and in certain spots at Morogoro and Kilosa. It settles in crowds upon any exposed surface, such as face and arms, to drink the perspiration. It causes much annoyance by hovering in front of one's eyeballs, and I noticed they congregated on the lower eyelids of the transport mules to drink their tears during the campaign, and caused the animals considerable suffering or at least discomfort. I have often brushed them off as one would a fly without ever receiving a sting. (Morogoro, 24. i. 18.)

46. *APIS MELLIFERA ADANSONI* Latr. The East African Wild Honey-Bee is one of the greatest pests in the country. In Nairobi they do not cause much trouble, but in Tanganyika Territory they were a great nuisance during the campaign. The battle of Tanga was a classical instance; in this fight, firing through the trees annoyed the bees, who attacked and routed both combatants\*.

My first introduction to the aggressiveness of the insect occurred near Moshi when crossing a clear, fast-flowing stream. With legs crossed on my mule's neck, the water being up to the saddle-flaps, I was almost unseated by the sudden start given by the animal, which ducked her head under water. The next moment something stung me on the back of the hand which for the moment I imagined to be a tsetse, an insect with which I was unacquainted at that time and which we had been told to look out for in the vicinity of these rivers. Glancing down, however, I saw it was a wild bee, clouds of which were coming round us, and many of my companions were already stung. The horses, without requiring any urging, started splashing and galloping

\* Von Lettow in his book on this campaign states that the bees were enraged by the firing of his machine-gun company, which had to retire no less than the enemy, and that the widespread rumour that a trap had been laid was entirely fictitious.

through the water and scrambling up a very steep bank. Nearly all the men were waving their helmets wildly about their heads, which was probably a mistake, as most of the stings received proved to be upon the head. I myself received between fifteen and twenty—two of these were on my arms, one on a finger, the rest were about the ears and on the head.

We stampeded for a quarter-of-a-mile before pulling up in answer to the blowing of a whistle—it was a good thing that none of the enemy was about to take advantage of our disorder. As we formed up into squadrons one of the officers rode down the line asking for me, as he knew that I carried a pair of entomological forceps and he wanted a sting removed from just below the eye. One man, who had dropped his helmet and gone back to fetch it, claimed to have a hundred stings; sixty were removed by a friend of his that day, and I took out eleven the following morning. The stings were much more severe than those of an English wasp, and the unpleasant effects lasted from 24 to 48 hours. The person of a hundred stings had the site of each marked with a purple spot. One of mine had a dark clot of blood at the site of puncture, and there was a swelling for six inches around this; the other stings I received caused scarcely any swelling. The nest must have been dependent from one of the branches overhanging the river, and I imagine that someone had brushed against it. (Nr. Moshi, 13. iii. 16.)

At Handenian Indian was stung to death. The unfortunate man had entered a deserted banda in which was a bee's nest, and the swarm had attacked him; it is surmised that he tripped and fell, for when found he was lying unconscious by the roadside and expired shortly afterwards. I was told that a couple of mules were stung to death near the same spot. When at Morogoro, a monkey was brought to me that had been stung to death by bees. At the time of attack it was chained to a pole, and though several persons made gallant attempts to rescue it they failed. On removing its skin there was scarcely a square inch of its body unmarked by a sting, the surface of the flesh being covered with blood.

A swarm entered my monkey's box, which was fixed on a tall pole; the animal became excited and received two stings, on eyebrow and neck respectively. It was rescued by my boy, who received three stings; three other natives who were passing also got stung. At 5 p.m. a Kavirondo dug out the pole and, balancing it on his shoulder, walked through the camp with it; on nearing the incinerator the bees got excited and, buzzing about his face, caused his nerve at last to give way, so that he dropped both pole and box and fled incontinently. It so happened that the box containing the irate bees fell in the vicinity of the native latrine; and the rapid exit of boys from the place in various states of attire caused much merriment amongst their fellows. A sting which I received upon my cheek took three days to subside, (Morogoro, 9. ii. 18.)



A galvanised iron building in which I took up residence for a time had a cupboard in one corner, in former times the place being used as a cotton-mill. This cupboard had two pipe-like apertures, and seemed to the local bees to be an altogether desirable nesting-site. On 9.i.17 they swarmed, numbers of them buzzing up and down the window pane by my table. Others persistently buzzed round my nose—not that that organ is in the least flower-like: one of these bees being struck at, stung the offending forearm some three inches above the wrist. The sting was not left behind, and the pain, sharp enough at first, subsided in fifteen minutes; the arm swelled considerably, and this swelling did not entirely disappear till the 13th, *i. e.* four days later.

On January 26th they were again unusually bad. Nearly a thousand must have invaded my quarters during the day; they came like a cloud, and at one time there must have been fully five hundred on the window panes; the noise created reminded one of the room of a wireless operator. I just managed to carry on with my work, though the angry humming of some round nose and mouth was trying to the nerves. On February 5th I killed 747 bees on the window pane by quietly crushing them one by one with a little metal pill-box. One hears of swarms everywhere. Whilst seated writing near the window, I was unexpectedly stung upon the eyelid by a bee which flew in at the window and straight to my eye without any provocation whatever on my part; the poor creature could not extricate its sting, and I had to pull it off forcibly, after it and my eyelid had fluttered up and down for a few seconds. It is very usual for these bees to attack the eyes, and is not a matter of chance.

Another time I noticed some boys pulling a hamali cart in the road outside, when a sudden commotion arose. One native dived beneath the cart and tried to conceal his head beneath his arms, another stripped off his kanzu and tried to wrap his head in it and ran away; the bees were left in the road in possession of the cart, which probably contained some sweet stuff. A similar instance came to my knowledge at Kilosa, where the cart contained goor; the bees held up all the traffic in one of the main roads while they looted the cart.

Twice I dislodged the offenders from the cupboard aforementioned by means of smoke. On a third occasion I was telling a friend of my troubles, when he said "Why do you not clear them out?" I remarked that I had not the necessary materials for making a smoky fire. He made answer: "What do you want with a fire, a stick is all that is necessary?" I fetched him this, and then, seeing that he was in earnest, took refuge inside my mosquito net. The cupboard, I might add, was nine feet high with a floor-space of about four feet square. Presently I heard the stick striking about in the cupboard, and he called out that the bees were all gone, in proof of which he poked out a large piece of comb on the end of the stick. It was perfectly true; he had knocked down the nest in broad daylight, and the



bees had fled out of the pipe-hole like a cloud of smoke and he had not received a single sting. He said that to the best of his knowledge he had never been stung in his life, but a few days later this was no longer the case, for he donned a cap in which was one of his homeless bees, and he was stung on the head. Within the next few days he received several more stings.

The bees are dependent on water, and if they get into a room from which there is no escape they soon die. They are very fond of sisal flowers, and clouds may be observed round the tops of the poles when the flowers are in bloom. The blossoms of the rubber-trees are another favourite source of nectar, but the resultant honey which I have tasted is bitter and unpalatable to the European, though the natives devour it readily. A strange thing that I noticed at Morogoro was their liking for commercial rubber. Some boxes of this stood in the sun just outside my quarters, and the heat melted the rubber which leaked out from the damaged boxes; the bees might be seen crawling over this at all hours of the day. Urine also seems to have a great attraction for them. When the rubber blossoms are in bloom the presence of the vast numbers of bees attracted to the plantations causes numbers of Bee-eaters (*Merops apiaster* and *nubicus*) to congregate.

They have few enemies I imagine. When swarming in the office roof numbers of them got into the web of a spider, which after wrapping them up very effectually in silk, cut them loose, so that they were constantly landing on my table. A robber-fly settled on my wife's arm one day with a bee in its grasp; a leg of the bee had got entangled in her sleeve, and some movement caused the insect to fly off; but returning, and failing after several attempts to disentangle its prey, it settled down and sucked the juices *in situ*. (Kilosa, 18.i.22.) A mantis was seen to take one from the window one day, as is mentioned elsewhere.

At Kilosa on 14.ii.21 a comb measuring some six inches in length and three-and-a-half across was formed in the store. This was the work of four days, the swarm being small—a large swarm will make an astonishing quantity of comb in a short time. One swarm, which had been established for fully a week in the office roof and had a huge comb with quantities of honey, suddenly left at 10 a.m. in the morning without any apparent reason; I watched them go, and then examined the comb and found but two bees left.

On 12.ii.22 I recorded that there had been four swarms in the office and three in my store-room during the past month. This swarming generally takes place during the earlier part of the year, synchronising with the greater rains and the abundance of food furnished by the rubber blossoms, which doubtless assists multiplication and the necessity for swarming.

Mr. C. F. M. Swynnerton devised a most effective way of dealing with them. A small quantity of cyanide was crushed and dissolved in hot water and squirted over the swarm with a syringe after dark, with the result that they fell like a shower of rain.

and only a few individuals would ever recover. For greater effectiveness the swarm would be enclosed as much as possible with matting supported by poles.

47. *BELONOGASTER GRISEUS* Fabr. (Vespidæ : Diploptera). These wasps, whose paper nests are to be found pendent from the verandah ceiling of most East African houses, were originally inhabitants of caves, I suppose. One day I came upon a huge overhanging rock—almost a cavern—from whose roof were suspended at least thirty large nests of this species; the half-dozen workers hanging to each assumed threatening attitudes in characteristic fashion at my approach. On my going still nearer, one flew off and stung me on the chin—a thing they rarely do in houses, where they are more used to human beings. The pain was not very bad, though the resultant swelling caused several kind enquiries as to whether I had toothache. (Mt. Longido, 13. ii. 16.)

In climbing a Flamboyant Tree to reach a dove's nest I had the misfortune to disturb the wasps on a nest below me. The first intimation of this was the receiving of a sting on the calf of my leg, six inches below the knee. I drove the wasp off, but in doing so received another sting on my first finger. The sting on the leg was bleeding, and looked as if a piece the size of a pin's head had been bitten out. Putting on my puttees I went off for a four hours' walk, feeling scarcely any inconvenience. On removing the puttees at one o'clock I noticed that the leg had been trying to swell under its wrapping. By 2 p.m. I could scarcely walk, and the limb was very swollen. At 6 p.m. the poisoned leg measured  $14\frac{3}{4}$  inches as against the  $13\frac{3}{4}$  inches circumference of the other. Next morning it was 15 inches. I had no idea that a wasp's sting could have such bad effects. The finger swelled a little, but this subsided the same day; it was stiff and a little sore on waking the following morning, but had evidently had a much smaller dose of venom. (Morogoro, 15. vi. 17.)

48. *SYNAGRIS ÆSTUANS* F., subsp. *RUFA* Stadelmann (Eumenidæ). I came across the nest of this species for the first time to-day. It consisted of two mud-cells, roughly  $35 \times 20$  mm. in length and breadth. These were side by side on the under surface of a leaf and attached to the mid-rib. The leaf measured 700 mm. in length, but by reason of the weight attached, hung vertically. The lower cell was already sealed; the wasp was resting in the upper one with its head outwards, completely closing the entrance; this was at 4.15 in the afternoon, the weather being dull and cloudy. (Kilosa, 25. iii. 22.)

49. *PSAMMOCHARES VENANS* Kohl, ♀ (Pompilidæ : Fossoria). My wife, who was preceding me down a rough path, suddenly jumped from her cycle and called me to see "such a large spider being stung by a wasp." As I reached the spot the spider was standing on its anterior legs; it might have had six applied to the

ground, but my impression was four, the remainder being in the air and the ventral surface of its abdomen so tilted as to be visible to me standing above. The ventral surface of this spider (*Ctenus* sp., ♀: Clubionidæ) is a very bright scarlet with a black basal patch, ornamented by two very white spots which, I take it, serve as eye-spots. The spider was a female I believe, as I am familiar with the species, having taken one only half the size of this specimen the previous week.

The wasp, which had flown off when first disturbed, had now returned, and was running hither and thither between the stationary cycle wheels looking for the spider; when close to its victim the latter bolted with great swiftness across the road, absolutely abandoning its "warning" or "terrifying attitude." Swift as it was, the wasp was swifter. I could not say if it ran or flew along the surface of the road—probably a combination of both; on overtaking the spider it pounced upon it with the greatest ferocity, curved its abdomen under, and stung vigorously; they rolled over in the road, and as I had nothing but a pen-knife wherewith to capture them, unfortunately they were somewhat damaged. (Kilosa, 28. ii. 22.)

50. *DOLICHOMUTILLA GUINEENSIS* Fab., f. *AURATA* Bischoff (Mutillidæ). Rolled in my blankets under a bush, and reading by candle-light, I felt an insect crawling up my leg. Supposing it to be an ant I attempted to brush it off, when I felt a sharp sting, whose effects travelled quickly up my leg to the hip. The pain lasted 48 hours and was like a bad nettle sting, leaving a red and lumpy rash. (Haudeni, 25. vi. 16.)

At Morogoro and Kilosa these wingless females were constantly found in the house. At 4.15 p.m. one having crawled up my leg, got caught between my stocking and slipper. It stung me on the upper surface of the foot about  $1\frac{1}{2}$  inches behind the little toe. For ten minutes the pain was frantic—far worse than a bee sting. An hour afterwards all pain had disappeared, but treatment had been adopted by placing a small crystal of potassium permanganate on the site of the sting. (Kilosa, 7. vi. 21.)

#### HETEROGYNA (ANTS).

The actual specimens referred to were only received for Nos. 52 and 53.

#### 51. ?*PALTOTHYREUS TARSATUS* F. or *MEGAPONERA FÆTENS* F.

A flight of termites had just taken place after heavy down-pours of rain, and the termites were busy discarding their wings, when I noticed one of these ants carrying off a termite; another ant was carrying a spider, whilst a third was laboriously dragging along a stick-insect many times its own bulk. (Longido West, 30. i. 16.)

Passed a dozen or more companies of the large black Ponerine ants which wander across the road in a fusiform body, quite

unlike the well-ordered columns of the siafu. Neither do they attack anyone who disturbs them, like the siafu, but, instead, run hither and thither, making a hissing noise not unlike that which a snake might make when rustling away among dead leaves. Perhaps it is an imitation which serves their purpose. (Kerogwe-Handeni Rd., 6. vii. 16.) Later experience of these ants makes me wonder why they were in fusiform formation when I made the note, for generally the hosts are in column formation, unless I am confusing two species.

52. *PALTOTHYREUS TARSATUS* F. I have already described the combat of this species with siafu, and have recorded elsewhere how they attack the eyes of tortoises, causing the poor beasts to die \*. Water-tortoises, however, when in their tank readily seize and eat *Paltothyreus*, as did my Fennec Fox (*Otocyon virgatus*) of his own accord when one of these ants emerged from a burrow near him. (Kilosa, 20. ii. 22, 25. ii. 22 & 10. iv. 22.)

I was throwing out some of the peppery seeds of a paupau fruit, when I noticed a sudden activity about the spot where they were falling, and to my surprise saw fully fifteen stink-ants carrying them off. Whether the ants had already been on the spot or had emerged from their holes on scenting the paupau I cannot say. They soon found the paupau in the tortoise enclosure and commenced carrying off the remaining seeds, so they are not wholly carnivorous in their diet. (Kilosa, 15. iv. 22.)

53. *MYRMECOPHILES* of *PALTOTHYREUS TARSATUS*. A number of these ants were drying their pupæ and larvæ on the path after heavy rain; on my appearance they started hurrying away, and I was astonished to see scores of *Lepisma*-like insects. (probably *Ctenolepisma* sp.) of all ages hurrying after them and running in and out amongst them, also a small beetle (*Orthophagus pugnatus* Boh.: Copridæ) in fewer but considerable numbers followed the ants in company with the *Lepisma*; when touched, these beetles shammed death. Mr. Arrow, who kindly named the *Orthophagus*, said that it was a common species, and suggested that its presence with the ants might be accidental, but there was no doubt about the existence of a true association. (Kilosa, 16. ii. 22.)

54. *CREMASTOGASTER CASTANEA* Sm., var. *TRICOLOR* Gerst. A pin with an atom of food on its point was lying on a ledge, when I noticed five of these ants take hold of it and carry it to the edge of the ledge. One ant appeared to be supporting most of the weight, having gripped the pin near the point. I therefore chased off the other four ants and timed the fifth, which supported the whole weight of the pin for fifteen minutes, when I had to leave. (Kilosa, 30. xii. 21.)

These ants, which are a perfect pest in a food cupboard, being fond of meats as well as sweet things, lately started eating

\* Proc. Ent. Soc. Lond. 1922, p. xli.



away a cork to get at the raspberry syrup which the bottle contained. It was not a question of eating the surface of the cork which might have been in contact with the syrup, they ate right into the heart of the cork and then downwards. (Kilosa, 15. iv. 22.)

On sitting down to breakfast I noticed one of these ants walking round and round the stem of a vase. I commenced to count how often it did the round, and after 39 times, found it took two minutes to do 29 rounds; at the end of five minutes it seemed to be going as strong as ever, so again timed it, and found it did a little more than  $14\frac{1}{2}$  rounds per minute. At the end of ten minutes, as we were timing it again, it began to vary the tour by turning about, and only did  $9\frac{1}{2}$  rounds to the minute. It had, however, already done some 150 rounds, and, falling back into its old stride, continued for another five minutes, making in all a quarter-of-an-hour since we began to time it; during this time it had accomplished approximately 200 rounds of a circle  $4\frac{1}{4}$  inches in circumference, giving us an idea of its accomplishments when in column, of 96 yards per hour or more probably 100 yards per hour.

The ant then came down on the table-cloth, but soon returned to the groove and recommenced its absurd parade, which it was still doing when I returned to lunch four hours later. It had, of course, come in on the fresh-cut flowers and was far from home and friends, but why should it exhibit so little intelligence as to wear itself out in this manner? Was it the scent of its own feet that hurried it along, thinking it was on a regular run, or was it the reflection of itself in the highly-polished concave groove that made it fancy it was accompanied by others? I cannot say, but that it was not a foolish individual is proved by the fact that whenever flowers are brought in with this species upon them the same thing happens, sometimes as many as four ants taking part in the procession, frequently going in opposite directions and moving out of each other's way when they meet. (Kilosa, 18. v. 22.)

55. *CARDIOCONDYLA EMERYI* For. An ant which causes a great deal of inconvenience to householders I call the "Sugar-ant" from its fondness for that commodity in particular, and sweet things in general. In my present quarters they swarm on the bed, table, and cupboard and many of them die in the jam; they cross one's paper when writing, and have to be brushed off one's neck, but never retaliate. (Morogoro, 14. xii. 16.)

It is interesting to note that the sugar-ants which formed long columns to and from my cupboard are now absent; only a few individuals are to be seen each day. (Morogoro, 20. iii. 17.)

56. *PLAGIOLEPIS (ANOPLOLEPIS) CUSTODIENS* Sm. This species is very abundant both at Kilosa and Morogoro, where it will be found running about in incredible numbers on paths and open ground and sometimes swarming on tree-trunks. They attack



any small insect which they can overpower, and to-day I found a small toad (*Bufo regularis*) being actually dragged along by a host of these ants, which so obscured their burden that until I had picked it up and shaken them off I could not tell what it was. These ants cause the natives considerable annoyance by biting their bare legs. (Morogoro, 12.ii.17.)

57. *CECOPHYLLA SMARAGDINA* F. This long-legged, somewhat transparent-bodied, yellow ant fastens leaves together to form its nest, and should one brush against the branch bearing the nest, the occupants rush out and stand quivering all over it, whilst others hurry off with open jaws to seek the disturber of their peace and soon cover all the foliage; when they get upon a person they bite savagely, more often on the neck than elsewhere. Their favourite tree is the mango, upon whose fallen fruits they feed; they also eat paupau; I have never seen them carrying insects. They nest in Javanese silk-cotton trees, which bear leaves that seem to be suitable for their purpose. (Kilosa, 21.v.22.)

58. *DORYLUS (ANOMMA)*, probably *NIGRICANS* Illig. The *siafu*, to whom I have referred elsewhere\*, have few enemies. One morning I shot one of those timid creatures, an elephant shrew (*Petrodromus nigriseta*), beside a column of ants, which were crossing a bush-path at 6 a.m. To my surprise, on opening the stomach of the shrew, I found it to contain a number of these pests. (Morogoro, 12.vi.17.)

59. *DORYLUS HELVOLUS* L. On no fewer than three occasions my attention was drawn to amphispænidids (*Monopeltis colobura*), which had been attacked underground by these fierce ants and so tortured that they came to the surface, on one occasion at 2.15 p.m., when the sun beat fiercely upon the scorching sand—conditions which these burrowing lizards detest. This species of ant will attack any freshly-killed body from underneath, but appears to hate the light, and never exposes itself. (Lumbo, 1.ix.18.)

60. *CAMPONOTUS (ORTHONOTOMYRMEX) SERICEUS* F. One of these greyish ants, which are very common in the house and seem to be much addicted to jam, was carrying a spider along the floor. I picked up another carrying a small chrysid. (Kilosa, 1.xii.20.)

61. *CAMPONOTUS* sp. I believe it was one of the many species of this genus which disturbed me when lying down beneath a giant tree to sleep, rolled up in my blanket; they invaded me in hundreds and were about half an inch in length. Unfortunately, when turning over, I imprisoned one between my cheek and pillow, and received a severe nip. (Ngeri-nger, 24.viii.16.)

I noticed an ant in my tent to-day which appeared peculiar, and on examination it proved to have the head and thorax of

\* Proc. Ent. Soc. Lond. 1922, p. xxxii.

another ant of the same species attached to its antennæ by the jaws of the dead head. Presumably the wearer of this ornament had bitten his comrade in half during some argument. (Morogoro, 30. vi. 17.)

### COLEOPTERA.

The actual specimen referred to was only received for No. 65.

62. *CICINDELA BREVICOLLIS* Wied. A number of these beetles were collected on sandy ground and paths by the river-bank; they harmonized so well with the ground that they were very difficult to see. They were also extremely active, taking to wing on the slightest provocation. (Morogoro, 14. xii. 16.)

63. A tiger-beetle apparently of the same species, flying in front of me, kept settling motionless on the path. I, thinking it was a tsetse, wondered what it was doing there, seeing we were in a cultivated area of some extent, so jumped off my cycle and then saw that it was a beetle. I stalked it, and shot it with a garter! (Kilosa, 1. vii. 21.)

64. *ANTHIA STRIATOPUNCTATA* Guér., ♂. This large Carabid was seen running across the arc of light in front of my tent about dusk. In attempting to pick it up, I thrice felt a coolness upon my hand—the fine spraying of a liquid. Just then my boy arrived with a killing-bottle, and as he knelt to seize the beetle, it discharged this secretion full in his eyes, which were at least eighteen inches away, I believe. The pain caused was agonizing, and though bathed immediately, his eyes became very bloodshot and swollen, and so remained for three days, when the discomfort of the protruding eyes had practically subsided, though they were not normal for some time afterwards. The odour was very powerful, flying to the eyes like formalin\*. The beetle is quite common in the district. (Izikisia, Tabora Dist., 15. xi. 21.)

65. *POPILLIA LIGULATA* Ohs., ♂ (Rutelidæ). Among a series of these beetles collected by Salimu during the past week was a Rutelid whose right meso-leg was missing—had never grown. On the opposite side the middle leg had three feet with one base—that is to say, the beetle had five legs on the one side and only two on the other. (Uluguru Mtns., 1. iii. 1921.)

66. *MYLABRIS OCULATA* var. *TRICOLOR* Gerst. (Mylabridæ: Heteromera). In my note on the ovipositing of this beetle which was kindly communicated by Prof. Poulton, he drew attention to the typescript being indistinct as regards the fraction of an inch expressing the length of the eggs (Proc. Ent. Soc. Lond. 1921, p. xcii). This should read one-eighth of an inch, and not one-third.

\* Compare Dr. Carpenter's experience with *Anthia fornasinii* Bert. (Proc. Ent. Soc. Lond. 1918, p. c) and his experiment on a monkey with *A. striatopunctata* (Trans. Ent. Soc. 1921, p. 10); also Dr. Marshall's experiments on monkeys with beetles of this genus (Trans. Ent. Soc. Lond. 1902, pp. 510, 511).

67. *MYLABRIS DICINCTA* Bertol. In this connection I came across a note to the effect that this red-and-black beetle was excavating a burrow on a native path through the mealie crops. (Morogoro, 9. vii. 17.)

68. *MYLABRIS* sp. A number of *Mylabris* beetles with scarlet-marked elytra were feeding upon some *Cucumis* plants on May 29th and again to-day. On both occasions there were about eight to each plant and none on the surrounding herbage. The interesting thing about them was the way the males (which were much smaller than the females) followed the females up and down the stem or leaf as the case might be, stroking their elytra and abdomens with their antennæ. Both antennæ of the male would be raised simultaneously, and with these he stroked the female most caressingly. The larger beetle fed unconcernedly or walked about, followed closely by her devoted attendant. (Ngong, Nairobi, 3. vi. 15.)

### LEPIDOPTERA.

The specimens referred to were received for Nos. 70, 75, 76, 77, 78, 80, and probably 73, 74, and 79.

One never gets tired of the wonderful butterfly fauna of East Africa; and between Mt. Kenia and Mozambique at one time or another, the writer has seen extraordinary assemblages of them in almost inconceivable numbers and variety, but nothing ever surpassed the display on 17. iii. 16, when they were feasting on the dead transport animals left stranded on the wayside by the tide of war.

On leaving Moshi for Kahe we passed through miles and miles of rubber, coffee, and other plantations. It was a glorious though somewhat steamy day after heavy rain. Never in my life have I seen such thousands of butterflies, all apparently freshly emerged, as they were in the pink of condition. There was one patch of *Papilio demodocus* about eighteen inches in diameter and containing about one hundred closely-packed insects feasting on the intestines of a bullock. On a raw buckskin there was a big crowd of blues, and every puddle in the road was surrounded by numbers of them. (Kahe, 17. iii. 16.)

69. *EURYTELA HIARBAS* Drury. Came upon a bush to which a number of Cetoniids were clinging; one of these was on the lower side of a horizontal branch, and immediately above him was the Nymphaline *E. hiarbas*, which was applying its proboscis to a spot of moisture on the twig immediately above the beetle's head; each time it protruded its proboscis to do so, the beetle relaxed its grip with one of its pro-legs and waved it in the direction of the butterfly; replacing the leg, it repeated the action with the opposite leg; the object of this was to drive the butterfly away from the exuding sap. Returning later I found no fewer than three beetle-butterfly groups, and concluded that the

beetles scarify the twigs to obtain the sap, and resented the butterflies partaking of the fruit of their labours. Later in the afternoon a larger Cetoniid was seen in a tree going through the same performance with a *Charaxes*. (Karura Forest, Nairobi, 21. vii. 19.)

70. *TERACOLUS CASTA* Gerst., ♀ (Pierinæ). Took a butterfly to-day with one pair of wings fully developed; the other pair still in the chrysalis. The butterfly was vainly flapping its forewings. (Kilosa, 13. xii. 20.)

71. *CATOPSILIA FLORELLA* Fabr. (Pierinæ). Besides the migration of this butterfly noticed on 3. v. 15, another migration lasting several days was witnessed in 1919. In both cases the butterflies were going in a north-westerly direction. In the second migration the wind was strongly in their favour, but if I recollect aright, adverse on one somewhat cold day\*. (Nairobi, v. 19.)

72. *PAPILIO DEMODOCUS* Esper. Watched this Swallowtail curving its abdomen under the leaves of a lime-tree for purposes of oviposition. It did not seem easily satisfied in the selection of a leaf, and the eggs were laid singly. (Kilosa, 28. xi. 20.)

Took a very young larva which has a wonderful resemblance to a bird-dropping. (Kilosa, 29. xi. 20.)

Very common *in cop.* just now. (Kilosa, 18. xii. 20.)

From later observations I have come to the conclusion that the species breeds all the year round, though principally in the rains. Larvæ were taken at Durban on 21. xii. 14.

73. *NEPHELE PENEUS PENEUS* Cram. When the rubber-trees are in bloom hundreds of these hawk-moths are to be seen flashing about the tree-tops, where they are difficult to obtain. Later in the season they come to the paupau flowers, and the only way to net them is by cutting off all the leaves of the paupau-tree. They are not nocturnal, strictly speaking, but crepuscular, becoming active again about 5 a.m. (Kilosa, 31. v. 22.) Flying with them was the much rarer *Nephele bipartita* Butl.

74. *ACTIAS MIMOSÆ* Boisd. (Saturniidae). Discovered the cocoon of a Queen Moth, which is one of the prettiest things in the way of cocoons. It was spun on the lichen-covered twigs of a fir-like tree. It is of a very silvery appearance, and if a section be cut out, the texture will be found so strong that it is impossible to tear. There are small breathing-holes at the top end, just beneath the opening from which the moth emerges. At the lower end are a few more holes, possibly for the sake of a current of air or to carry off any moisture. (Makindu, 31. vii. 16.)

\* Compare the records of migration of this species in Proc. Ent. Soc. Lond. 1921, p. xxiii.



Of four live cocoons received yesterday from Natal a male emerged at 2 p.m. this afternoon. By 3 p.m. it seemed to have finished developing the wings, whose monstrous tails are 3 inches in length. At 4 p.m. it opened the wings and rested with them flat—the resting moth had a most striking appearance. (Nairobi, 23. viii. 19.)

At 9 p.m. I heard a crackling noise from one of the remaining cocoons, from which I had cut a small section the better to observe the pupa within. The latter was swollen, making the abdominal rings very noticeable. I watched the moth climb from the funnel and withdraw its abdomen very suddenly; after recovering from its exhaustion, it adjusted its position on the outside of the cocoon. With the exception of the mauve costa, the wings appeared to be entirely orange-yellow at this stage; a pale green blush began to suffuse the wings, commencing at their basal parts. The green spread and deepened in tone until it had replaced the greater part of the yellow. On emergence the tails were very short—a quarter of an inch perhaps—and were the last part of the wings to develop. At 11.45 p.m. I was awakened by the moth flying round the room, and on turning up the light found a second specimen had emerged and was nearly dry. Both were males. (Nairobi, 27. viii. 19.)

75. *RHODOGASTRIA VITREA* Plotz (Arctiinae). When walking up the path at 4 p.m. I disturbed a hunting party of the Helmeted Shrikes (*Prionops talacoma*), which flew into a large tree overhead and recommenced their researches there. Immediately afterwards a fine moth in emerged condition dropped down on the path, almost at my feet. I poked it with a twig, but, as it did not move but shammed death, tried to pick it up by one of its vivid red legs, whereupon it began to exude a bright yellow fluid from both "shoulders," this fluid coming out as a froth with a marked rotary motion. I passed the twig beneath the moth, hoping it would clamber up it; to my surprise it seized the twig with its hind-legs only, and, as I raised the stick in the air, it picked up two lumps of quartz from the path, the larger lump measuring  $10 \times 15 \times 6$  mm. As I carried the moth along with me, it carried the quartz for fully a minute before dropping it, and for yet another minute it remained supporting its own weight by its hind-legs. The pillars of froth stood up well from its shoulders, being about 3 mm. in diameter and 8 or 10 mm. long. Suddenly the froth dissolved into drops, which fell upon my hand, and the moth with rapid darting flight made off. The fluid smelt to me like the secretions of the cloacal glands of a British Grass-snake, which is also used as a defence\*. (Kilosa, 8. vi. 21.)

\* Dr. Carpenter has observed the same method of defence in an allied species, *R. leucoptera* Hmps., and has recorded the acrid odour and taste of the secretion (Proc. Ent. Soc. Lond. 1913, p. xevii).



76. *MAXERA MARCHALI* Boisd. (Ophiderinæ : Noctuidæ). Whilst in the garden my wife's attention was drawn to something moving amongst the dead leaves. A rolled-up leaf  $19 \times 8$  mm. was making progress by a series of little jumps. Placed on a tablecloth, it journeyed first in one direction and then in another quite aimlessly. On opening the leaf a flattish moth larva was found. (Kilosa, 12. iv. 22.)

On opening the leaf I found the maggot-like larva had pupated. (Kilosa, 24. iv. 22.)

On going to the box in which I had placed the chrysalis, I was sorry to find the small brown moth had emerged some time, as it was already dry; the time taken for development was thus extremely short. (Kilosa, 5. v. 22.)

77. *ANAPHIS RETICULATA* Walk. (Notodontidæ). Last November I found the cocoon of a wild gregarious silk-moth. The cocoon is a khaki-coloured, strongly-woven structure 190 mm. ( $7\frac{1}{2}$  inches) in length and 110 mm. ( $4\frac{1}{4}$  inches) in diameter at the broadest part. Through its axis passes a branch of the food-plant, whose twigs and leaves are incorporated with the mass of silk. At the upper end are two chimneys or funnels protruding 20 mm. ( $\frac{3}{4}$  in.) from the surface of the pear-shaped cocoon. Through these the moths emerge at dusk and for two hours afterwards. I never recollect seeing any emerge after 9 p.m., though doubtless they occasionally do so.

The business-like hurry with which the moths emerge, as if accustomed to do so all their lives, is quite amusing. The head of each moth as it emerges is protected by a little helmet of shamrock-shape, each of whose "leaves" is deeply concave. This helmet is, of course, part of the head-piece of the chrysalis, and serves to protect the eyes and delicate head of the moth as it pushes its way out of the funnel. As soon as the head was clear of the funnel, up went a pro-leg and gave a push to the mask, which fell to the ground; quite a heap of these were found each morning almost immediately beneath the funnels.

Moving hurriedly and crabwise the insect then travels from the funnel to the under side of the cocoon, where it hangs whilst its crumpled and draggled wings open out, develop, and take shape, the brown lines on the creamy ground becoming clearly defined. The wings were then raised above the back in the position of those of a butterfly; from time to time they were shivered, apparently to test their muscles. After hardening, they are brought to the usual position of a moth at rest, lying one across the other upon the back, forming approximately a triangle. If disturbed at all the moth discharges a pinkish excretion, and this fluid leaves with such force that I should think it carries a distance of quite nine inches from the moth.

Theoretically this is the middle of the rainy season, but there have been no rains recently; nevertheless three of the moths

emerged this evening. I will give the rest of the dates of emergence serially, with the numbers of moths which emerged from the cocoon each day. (Morogoro, 18.iii.18):—

|                  |    |                  |    |
|------------------|----|------------------|----|
| March 19th ..... | 9  | March 25th ..... | 40 |
| „ 20th .....     | 13 | „ 26th .....     | 56 |
| „ 21st .....     | 10 | „ 27th .....     | 22 |
| „ 22nd .....     | 13 | „ 28th .....     | 9  |
| „ 23rd .....     | 16 | „ 29th .....     | 10 |
| „ 24th .....     | 25 | „ 30th .....     | 4  |

After this not more than ones or twos emerged at long intervals and often crippled, the total not exceeding ten. If we assume there were ten, it gives the astonishing total of 240 moths emerging from this one cocoon. (Morogoro, 30.iii.18.)

Found a second cocoon on a small shrub and, assuming the moths had emerged, put it away in a trunk. (Kilosa, 30.xii.20.) On opening the trunk I found some 14 or 16 had recently emerged. (Kilosa, 10.iii.21.) From this date the following emergences took place:—

|                  |   |                  |     |
|------------------|---|------------------|-----|
| March 11th ..... | 4 | March 17th ..... | 1   |
| „ 12th .....     | 2 | „ 18th .....     | 2   |
| „ 13th .....     | 2 | „ 19th .....     | nil |
| „ 14th .....     | 2 | „ 20th .....     | 1   |
| „ 15th .....     | 2 | „ 24th .....     | 1   |

This cocoon therefore only produced one-seventh the number of the former, which was quite twice its size. The total number emerging was 32. (Kilosa, 24.iii.21.)

Thinking a record of the incidence of sex among those that emerged would be more interesting than the bare totals, on receiving a nest from the Tabora District brought back by one of my native collectors, the results were tabulated as follows:—

|                     |                              |
|---------------------|------------------------------|
| December 26th ..... | 2, ♂ ♀                       |
| „ 27th .....        | 5, ♂ ♂ ♂ ♀ & ?               |
| „ 28th .....        | 3, ♂ ♂ ♀                     |
| „ 29th .....        | 2, ♂ & ?                     |
| January 9th .....   | 1, ♀                         |
| „ 10th .....        | 8, ♂ ♂ ♂ ♂ ♂ ♂ ♀ ♀           |
| „ 11th .....        | 12, ♂ ♂ ♂ ♂ ♂ ♀ ♀ ♀ ♀ ♀ ♀    |
| „ 12th .....        | 7, ♂ ♀ ♀ ♀ ♀ ♀ ♀             |
| „ 13th .....        | 2, ♀ ♀                       |
| „ 14th .....        | 1, ♀                         |
| „ 17th .....        | 3, ♀ ♀ ♀ (one was a cripple) |
| „ 18th .....        | 1, ♀                         |
| „ 19th .....        | 1, ♀                         |

Total emerged 47, composed of 2 not sexed, 19 males, and 27 females. As one would expect, males preponderate in the first days of emerging and females very markedly towards the

end. There is a curious gap between December 29th and January 9th, when none emerged; this was not to be accounted for by the weather, which was almost uniformly hot and dry throughout, though I believe one or two showers did occur. (Kilosa, 19. i. 22.)

78. AN AMYDRIA and another Tineid too worn to be identified; also *Ephestia cautella* Walk. (Phycitinae:Pyralidae). Writing from an ex-enemy cotton warehouse where I was camped for a few days:—"There are some hundreds of clothes-moths hatching out in this building every day, presumably having bred in the large stock of cotton which the Germans have housed here for two years past. I was very interested in seeing a dozen males assembling on the outside of my mosquito net and moving to and fro in ceaseless agitation over a square inch of net—not till then did I notice the female on the inside of the net. Killed the males. Next morning there were some more, so I killed the female and drove off the males, but they returned to the spot and continued to move over it for probably half-an-hour after she had gone." (Morogoro, 19. iii. 17.)

79. DREATA (JANA) sp. (Eupterotidae). The large and hairy caterpillars of this moth are from three to four inches long, and their clothing of fine hair over an inch in length makes them look inviting to stroke. The white or greyish hair, however, conceals sharp rufous-coloured spines arranged around the body segments. If you attempt to pick up this caterpillar the spines are driven into your flesh, where they remain, being very brittle. Fortunately they are not barbed, so they can be drawn out, though it is difficult to do so as they snap on account of the afore-mentioned brittleness. In endeavouring to pick up one of these larvæ to-day I utilized a leaf of a rubber-tree to protect my fingers, and was astonished to find the spines driven through the leaf and into my finger. Unless poison was removed in passing through the leaf, I do not think they are poisonous, as only mechanical irritation was felt. The leaf bristled with them, and a piece of paper proved to be no better protection. When interfered with, the caterpillar half curves its body, which has the effect of bringing the spines into prominence and making them more rigid, I think. (Kilosa, 25. iii. 22.)

One of the caterpillars cast its skin yesterday and the other to-day, though collected independently. (Kilosa, 7. iv. 22.)

80. PROCESSIONARY CATERPILLARS. I came across a proper caterpillar procession for the first time to-day. A clump of the caterpillars, owing to their long, wavy, white hair which almost obscured their dark green skins, had the appearance of a large luxuriant patch of American blight. The clump was about four feet from the ground on the bark of a tree, and reaching to the ground was a single line of caterpillars; another line led up from the clump. Each member of the procession had its head closely applied to the "tail" of its predecessor, and they moved forward

very slowly, after the fashion of London taxicabs closing up in a press. The caterpillars were  $1\frac{1}{2}$  inches in length. (Handeni, 27. vi. 16.)

Some six miles from Kilosa along the railway line for Kigoma is Jumbe Sunguru's village. Here close to the line is a mighty wild fig-tree, big as an English elm, and as I was passing it to-day I saw that every bit of this great tree as far as its topmost twigs was smothered in grey hairy caterpillars, each bearing on its back two spots—tufts of black hairs in reality. The caterpillars seemed to be moving slowly up the tree with long silken threads in great profusion as if to guide them, and as I walked around the tree surveying this wonderful sight from different points, I came upon a small column travelling with haste across the path. Following this line back, I found they were descending from a smaller tree—no larger than a crab-apple, and of much the same appearance—which still had plenty of leaves, so why they should leave a land of plenty and go on this pilgrimage to a tree already much depleted of foliage and overstocked with caterpillars, I could not understand.

I could not see the caterpillars feeding on the leaves, but a gentle rain of droppings kept falling, and the surrounding ground was already well-covered, whilst unsightly masses of web and silken thread loaded with excrement depended from the larger branches. It was difficult to see what the main body on the bole of the tree would get to eat to-day, but for the time being they had something else to distract their attention. Several minute black ichneumon flies were hovering over them, and when one of these approached a caterpillar, the latter would jerk its head and forepart of the body most violently backwards, and the little fly would move off. How it could get close enough to oviposit an egg in the skin of such a hairy caterpillar was the problem confronting the insect, but doubtless it would eventually succeed in doing so. (Kilosa, 30. vi. 21.)

On August 6th I revisited the tree and collected four pupæ which were concealed beneath a mat of webbing. Two were of one species and two of another.

Two pupæ were green, but the shells left after emergence were transparent and colourless except for their bright red "tails." They produced ochre-coloured moths with a reddish spot on each fore-wing—*Nygmia crocosticta* Hmps., or a race of this species, being smaller and more richly coloured than the type which came from the west of Lake Nyasa. (Kilosa, 14. viii. 21.) These moths are Liparidæ (Lymantridæ), a family not known to include processionary larvæ. They may have accidentally pupated in the web of the true processionaries or were perhaps definitely associated with them.

The two other pupæ were brown with four longitudinal series of golden-brown spots. They were 17 mm. in length over all, except the terminal spine which was a millimetre long. One moth either failed to emerge or was lost. The pupa of the other

was submitted to Mr. Tams who found that it contained a parasitic pupa which Dr. Waterston identifies as a species of *Brachymeria* (= *Chalcis* auct.). An anterior prominence on the moth pupa resembles that found in the Notodontid genus *Thaumetopoea*, known to have processional larvæ. The species may have been *T. apologetica* Strand, from East Africa, or an allied form.

### ORTHOPTERA.

The specimens referred to were received for Nos. 83, 85, 86, 89, 91, 92, 93, 94 a, 95, and 98.

81. ORTHOPTERA have many enemies. In the stomach of a Mongoose (*Mungos mungo colonus*) shot to-day were cockroaches, locusts, grasshoppers, and a number of other insects. (Morogoro, 11. xi. 17.)

A Kestrel's (*Cerchneis tinnunculus*) stomach contents showed it to have been feeding chiefly on locusts. (Morogoro, 4. xii. 17.)

A Cattle Egret (*Bubulcus ibis*) had a great number of grasshoppers in its stomach. (Morogoro, 14. xii. 17.)

### GRYLLIDÆ.

82. BRACHYTRYPES MEMBRANACEUS DRN. My first acquaintance with this huge cricket was at Morogoro, where an officer of the Flying Corps brought me a specimen  $2\frac{1}{2}$  inches long and  $\frac{3}{4}$  broad at the widest part; he rather aptly compared its song to the hum of a gnome engine. (Morogoro, 3. v. 17.)

One of these crickets was shrilling away beneath a shrub two nights ago: my boy located it, but it dived down its hole; he made a big excavation, but missed it; last night presumably the same cricket was under the next bush twenty feet away. To-night it was at the back of the house a hundred feet from its last location. I went to see it, and found it was just beginning a burrow into which it dived, but was easily dug out. It had a single egg in the oviduct, not round but slightly pointed at each end. (Kilosa, 12. iv. 22.)

Again, to-night I found a cricket shrilling outside its burrow, and was able to approach within a foot of it with an acetylene lamp, and stand some time before it made off. It also was a female with an egg ready for oviposition. Within a few inches of it was a gecko (*Hemidactylus squamulatus*) perfectly motionless as if dazed by, or enjoying, the noise. (Kilosa, 13. iv. 22.)

Each morning one sees little heaps of excavated sand about the camp, and near them are tracks, not unlike those of a rat at first glance, which show the extent of the insect's nocturnal peregrinations. At dawn, and for about an hour afterwards, it is not uncommon to find stragglers still above ground. If dug out they are usually not more than a foot below the surface. Lately I have been feeding the small Mongoose (*Helogale ivori*) upon



them, as they show much eagerness for this form of diet, snapping them from one's fingers.

83. *LIOGRYLLUS BIMACULATUS* de Geer. This species is very widely distributed throughout East Africa. At Mkomasi I discovered two crickets beneath an old battered biscuit tin; one was already dead and dismembered, the other in the jaws of a scorpion (*Odonturus dentatus* Karsch), which was busily engaged sucking its juices. As I was pulling the cricket away from the scorpion a Sand-snake's head was protruded from the tin. (Mkomasi, 2. vi. 16.)

#### TETTIGONIIDÆ = LOCUSTIDÆ.

84. *ENYALIOPSIS* sp. I caught two of the wingless long-horned grasshoppers which are very common here. I woke up with one on my face the other night, and several of my comrades have found them in their blankets. (Dutumi, 20. ix. 16.)

85. Larva of a species of *GRYLLACRINÆ*. On my table for a week past has been lying a newspaper cutting—a portrait. This morning I found it mutilated in circular fashion as might have been done by a rose-cutter bee. The cut-out portion had been turned up flap-wise and carefully cemented down to form a little cell without entrance; neither was there any trace of cement or silk. Opening this I found within it a pink larva. (Lumbo, 25. ix. 18.)

86. *CLONIA WAHLBERGI* Stål. A native brought me a specimen of this peculiar insect, the like of which I had never seen before. (Morogoro, 11. i. 17.) Two were subsequently taken at Kilosa, where they had apparently come to light. (Kilosa, 18. xii. 20 and 18. i. 21.)

87. *PSEUDORHYNCHUS PUNGENS* Schaum. Heavy rainfall last night and to-day; the countryside is teeming with these Orthoptera. They were just as thick as locusts, in a rubber plantation near here. One had to shield the eyes to protect them from the storm of insects which flew against one's face and body. The brown forms were greatly in the minority, being about 5 per cent. They showed no selection in choosing sites, as they settled on bright green rubber-leaves just as readily as in the dry brown grass. (Kilosa, 1. xi. 20.)

The insects are plentiful here also—i. e., some six miles from Kilosa. (Miombo, 4. xi. 20.)

#### ACRIDIDÆ.

88. *LAMARUKIANA* sp. I put one of these cryptically-coloured grasshoppers into a tin as food for a large *Mygale* spider (*Pterinochilus* sp.: *Avicularidæ*), but on opening the tin found that the grasshopper had killed the spider by biting its abdomen. (Nr. Moshi, 17. iii. 16.)

89. *SCHISTOCERA GREGARIA* Forsk. Locusts of this species travelling in a S.S.W. direction have literally peppered the sky to-day, but vagaries in the wind have caused many of them to settle. (Morogoro, 11. xii. 16.)

The most striking thing about the insect-life to-day were the locusts of two species (the second being *Zonocerus elegans*) which were simply swarming everywhere; the herbage was literally alive with the stragglers of the swarm of yellow adults that passed over here three days ago. I met a native woman putting them into a pail for dinner. On the middens outside the huts are great piles of wings and hind-legs, the relics of recent feasting. (Morogoro, 14. xii. 16.)

90. *ZONOCERUS ELEGANS* Thunb. A rather surprising situation for immature grasshoppers of gaudy colour were the holes caused by the larvæ of many species of longicorn in the thorn-trees, whose timber was almost as hard to cut as stone. Yet I took many of these young grasshoppers as high up as seven feet, and might have found them still higher had I chopped further up the stems. Immediately their hiding places were laid open they sprang into the air. (Mbunyi, 17. v. 16.)

This species is very interesting on account of the small proportion that develop wings. The insects frequently mate while their wings are quite rudimentary. The development of the wings is, I take it, a matter of no importance to the owner's safety, which is guaranteed to a great extent by its gaudy, aposematic colouring and offensive smell. (Morogoro, 14. xii. 16.)

These grasshoppers, apparently so warningly-coloured, are eaten with avidity by hungry lizards (*Gerrhosaurus major*) and somewhat reluctantly by a Chameleon (*C. dilepis dilepis*)\*. (Morogoro, 22. x. 17.)

This species comprised part of the stomach contents of a Crested Cuckoo (*Coccytes glandarius*). (Morogoro, 29. i. 18.)

Also found in the stomach of another species of Cuckoo (*Coccytes jacobinus*). (Morogoro, 29. xi. 18.)

91. *PHYMATEUS VIRIDIPE* Stål. Captured three large *Phymateus* insects of the usual vivid green colour with scarlet, blue, and green under-wings; there were four of them on the bush, nevertheless I did not notice them till the first moved. A curious mixture of protective and aposematic colouring, they are rather slow in their movements and only take short flights, relying for safety on the frothy bubbles discharged from glands situated just behind the large jumping-legs. (Ngari Mtoni, near Arusha, 4. iv. 16.)

Took a pair of these Acridians at Morogoro, where they are far from common. (Morogoro, 10. i. 17.)

92. *CYSTOCCELIA ABSIDATA* Karsch. Just by my tent someone caught a very queer orthopteron. Its length over all is  $4\frac{3}{4}$  inches;

\* Compare Dr. Carpenter's experiments on monkeys with this Acridian (Trans. Ent. Soc. 1921, pp. 8, 33, 53, 98).

$2\frac{1}{8}$  of this is occupied by the abdomen. A casque of  $2\frac{3}{8}$  inches protects the head and well-developed wings. In breadth the casque is  $1\frac{1}{2}$  inches, in height  $1\frac{3}{4}$  inches, and looks out of all proportion to the rest of the insect.

The colour of the creature is a pale green with mid-ribs and venations of the casque in yellow; the vein-like ribs are punctuated at intervals by yellow spots. Two peculiar silver blotches occur about half-way along the casque, one on each side; these can be seen from above. The upper wings have each a bright splash of ultramarine near their junction with the body. (Morogoro, 14. v. 17.)

#### PHASMIDÆ.

93. *PALOPHIUS GREYI* Grand., ♂. A native brought me a fine stick-insect measuring  $11\frac{7}{8}$  inches in length; antennæ  $4\frac{7}{8}$  inches; hind-legs  $4\frac{3}{4}$  inches; opened wing  $3\frac{7}{8}$  inches; elytra  $\frac{3}{4}$  inch long, each having a hollow excrescence resembling a thorn. Large stick-insects are rare in East Africa; I have only come across two during three years, and these were of different species. (Morogoro, 1. ii. 18.)

#### MANTIDÆ.

94. PRAYING MANTIDS non det. An egg-mass of a mantis, which I collected a month ago has just hatched out and given rise to a few score grotesque little black mantids. (Morogoro, 20. iii. 17.)

In the stomach of a Hornbill (*Lophoceros deckeni*) were two large and complete mantids. (Morogoro, 1. vi. 17.)

A Hornbill (*Lophoceros naumanni*) which was mobbed by some small birds had a large mantis in its stomach. (Morogoro, 15. vi. 17.)

94a. *DACTYLOPTERYX* sp. not in Brit. Mus. Took a mantis which gave me a great deal of trouble to capture. It harmonized most perfectly with the bark of the tree on which I found it, and ran round the tree and up and down with the agility of a gecko. (Morogoro, 2. ii. 17.)

95. *POLYSPILOTA ÆRUGINOSA* Goeze. Whilst at my meals all sort of trifles such as moth or fly wings come floating down. This is a sign that a praying mantis is also dining. He took up residence near the ventilating holes at the apex of my bell-tent, and is between the two covers. Apparently he finds it a good spot, for he has been there a very long time. (Morogoro, 15. vi. 17.)

One of the Black-headed Weavers (*Ploceus nigriceps*) surprised me to-day by dodging after a mantis in the fashion of a flycatcher. Almost immediately after catching it, however, it dropped it again, presumably owing to the mantis making good use of its toothed fore-legs and perhaps jaws. (Morogoro, 7. xii. 17.)

A specimen of this green mantis was brought me at 6 p.m., having been found on a tree-trunk. It deposited an egg-mass,  $1\frac{1}{2}$  inches in length and 1 inch in diameter, on the window frame before 8 a.m. It stayed beside the eggs till dusk the following evening, when it disappeared. (Nairobi, 7. viii. 19.)

The boy brought me two more specimens of this mantis—one immature but almost fully-grown and an adult. The latter measured in head and body 68 mm., abdomen only 45 mm. In its abdominal cavity, and quite free, I found a Gordian Worm (*Gordius* sp., Baylis det.) 378 mm. in length and 1.5 mm. in diameter. It would be interesting to calculate what length of worm a human could carry in proportionate body-weights if he were afflicted with such pests. (Nairobi, 12. viii. 19.)

96. *SPHODROMANTIS VIRIDIS* Forsk. Four or five days ago I brought a gravid mantis into the house; it spent most of its time resting on a vase of flowers near the mosquito-gauzed window. This morning a male mantis was on the gauze six inches from the female. I therefore went outside and brought him in at 9 a.m. The female was clinging to the gauze head upwards, about 9 inches below the male, who was head downwards. At 12.17 p.m. the female took two short steps in the direction of the male. At 12.19 p.m. with a rapid jump he sprang upon her, his head being towards her tail; he turned so quickly that his fore-legs grasped her just anterior to the middle pair of legs and base of wings. His second pair of legs rested on her wings, also his left posterior leg, the right posterior leg being in space. The terminal segment of his abdomen was twisted round in a quite impossible way to form the union. They remained paired thus from 12.19 p.m. to sundown at 6 p.m. (29. iv. 21). They paired again for a couple of hours at noon, but after this made no further attempts (30. iv. 21). Eggs were laid on the window gauze (24. v. 21). Eggs hatched; young sloughed shortly after hatching. They are greyish-fawn in colour, with legs striped like those of a *Stegomyia fasciata*, but not in such contrasting black and white. (Kilosa, 6. vii. 21.)

97. *OMOMANTIS ZEBRATA* Chap. A mantis, being put upon a mosquito-meshed window where there were three bees, carefully stalked them, swaying backwards and forwards with every step just like a chameleon. It is curious to note that two creatures so entirely different except in their green colour should have developed precisely the same gait, which to my mind is meant to simulate the movements of a leaf swaying gently to and fro in a breeze, and enables them to approach within striking distance of their prey—the one with its tongue, the other with its specially modified pro-legs. The mantis seized the bee with these; the abdomen of the bee was held as in a vice in the left, its head in the right; without loss of time the mantis bit into and crunched up the vital thorax, whilst the bee was quite powerless to retaliate. (Kilosa, 27. iii. 22.)



98. *MANTIS RELIGIOSA* L., ♀. The wings of this species were swarming with minute red mites. (Kilosa, 29.iii.22.)

99. *PSEUDOCREOBOTRA WAHLBERGI* Stål. Are mantids attracted to light like moths, or is it because of the moths they can capture that they come? I took two examples of this species at a light on the verandah last night. The eye-spots are seen to best advantage when the mantis raises its wings and rustles them in its usual "warning" attitude. (Frere Town, 2.vii.19.)

100. *IDOLUM DIABOLICUM* Sauss. Took an immature specimen of a chestnut-brown. The leaf-like outgrowth from the head reminded one of the Leaf-nosed Bats; other extravagant leaf-like outgrowths occurred from the limb-joints and on the thorax. (Dutumi, 15.ix.16.)

I consider the species uncommon in East Africa, but as it is so procryptically coloured my conclusions may be based on my own poor observation. I have only captured two specimens in six years, the second was taken to-day. (Kilosa, 18.xii.20.)